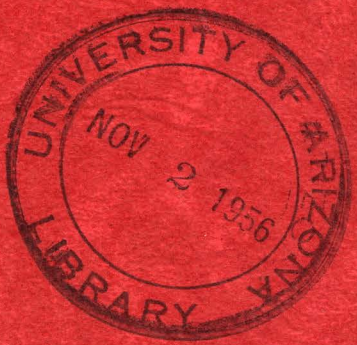
Report Number 139

September, 1956

THE COMPARATIVE VALUE FOR BEEF PRODUCTION OF IRRIGATED ALFALFA HARVESTED BY DIFFERENT METHODS

Progress report of a cattle feeding trial conducted at the University of Arizona Experimental Farm, Yuma, Arizona



Arizona Agricultural Experiment Station

University of Arizona

Tucson

THE COMPARATIVE VALUE FOR BEEF PRODUCTION OF IRRIGATED ALFALFA HARVESTED BY DIFFERENT METHODS

R.M. Richard, C.B. Roubicek, L.M. Rosenblatt
D.F. McAlister, R.R. Stone, and F. Pritchard

This experiment was designed to compare and evaluate different methods of alfalfa harvesting in a livestock feeding program, and to determine the effect of different supplements to green chopped alfalfa for growing and fattening steers. This trial was conducted at the University of Arizona Experimental Farm, Yuma, Arizona.

Summary:

1. Steers fed green chopped alfalfa plus a supplement of barley or molasses at a level of one-third pound per 100 pounds live weight made satisfactory gains and carcass grades.

2. There was no advantage in feeding the barley or molasses supplement at a level of two-thirds pound per 100 pounds body weight compared to the supplementation at half this level.

3. The supplemented green chop groups showed gains and carcass grades equal to hay fed steers which served as the control group.

4. No marked differences in feed consumption were noted between steer groups on the various rations. Consumption was slightly higher when alfalfa was fed as hay than when fed green.

5. Alfalfa was more efficiently utilized when fed as supplemented or unsupplemented green chop than when pastured. Rotation grazing was somewhat less efficient in feed utilization than strip grazing.

6. Bloat was a major problem in feeding and pasturing green alfalfa. Feeding alfalfa straw with green alfalfa was, at best, only partially effective in controlling bloat.

Experimental Procedure:

Eighty steers were divided equally into sixteen groups on the basis of weight. Two groups were assigned at random to each experimental treatment. The following treatments were used.

1. Alfalfa hay

2. Alfalfa green chop plus alfalfa straw

3. Alfalfa green chop plus alfalfa straw plus 1/3 pound rolled barley per 100 pounds live steer weight daily

4. Alfalfa green chop plus alfalfa straw plus 2/3 pound rolled barley per 100 pounds live steer weight daily

5. Alfalfa green chop plus alfalfa straw plus 1/3 pound blackstrap molasses per 100 pounds live steer weight daily

The assistance of the Experiment Station Statistician, Dr. Henry Tucker, in all analyses of these data, is gratefully acknowledged.

6. Alfalfa green chop plus alfalfa straw plus 2/3 pound blackstrap molasses per 100 pounds live steer weight daily

7. Alfalfa pasture rotation grazed plus alfalfa straw

8. Alfalfa pasture strip grazed plus alfalfa straw.

Steers fed alfalfa hay and green chopped alfalfa (treatments 1 through 6) were confined to drylot and fed their respective roughage in amounts which they would consume twice daily. Rolled barley was fed to steers on treatments 3 and 4 at least one hour prior to the feeding of green chop to enable complete consumption of grain before forage was placed in the troughs. Feeding grain with the freshly cut alfalfa was found to be unsatisfactory since it tended to result in incomplete grain consumption. Grain which was not consumed became moistened through contact with the green feed and tended to sour on standing. For steers on treatments 5 and 6, molasses was distributed over the green chopped alfalfa at the time of feeding.

Steers grazed by the strip method were moved daily and given a new pasture area containing sufficient forage for one day of grazing. Steers grazed in rotation were moved to a new pasture area weekly and confined to that area for one week. In following this procedure, complications resulted during certain periods when alfalfa growth was limited by cold weather. During those periods feed consumption of steers being pastured was restricted according to the amount of forage available.

Alfalfa straw was fed to all steers receiving green alfalfa. The primary purpose in feeding the straw was to attempt to reduce the incidence and severity of bloat. Straw was fed free-choice to steers on pasture by means of portable feeders. Cattle receiving green chopped alfalfa in dry-lot were fed the straw at a level of three pounds per steer daily during the earlier phase of the experiment; the allowance was later increased to four pounds because of the high incidence of bloat. Attempts to feed more than four pounds of straw to cattle in dry-lot were unsuccessful.

The steers were gradually adjusted to their experimental rations during a pre-test period of three weeks. The 168-day feeding trial was started December 24, 1955. Data were collected on feed consumption and body weight changes of test animals. The steers were weighed at 28-day intervals. Alfalfa hay, straw, and green chop were weighed as fed and moisture content determined. For pasture lots, feed consumption was estimated from clippings at the beginning of each period. At the termination of the experiment, steers were slaughtered and information obtained on live grade, carcass grade, and yield.

Discussion of Results:

During the course of the experiment, the following steer losses resulted: treatment 2, one steer died of bloat on March 7; treatment 5, two steers died of bloat on January 8 and January 20, respectively; treatment 7, one steer died of bloat on March 6, one steer died of other causes on January 19. For the 168-day feeding period, total gains were analyzed using data for animals which were carried through the entire study. The feed consumption of animals which died was estimated with the assistance of the station statistician and the necessary corrections made to prevent undue bias in calculating feed requirements per unit of gain on the various treatments.

When losses were obtained on pasture, replacement steers were used in order to maintain a constant carrying capacity. The gains of replacement animals were not used in evaluating the pasture treatment because of the necessary adjustment to new rations by the new animals. Another factor considered was that replacement animals differed in weight and condition from the animals replaced.

Methods of adjustment were considered in estimating the feed consumption by the animals which were removed from the experiment, (1) proportional to average body weight in each 28-day period; (2) proportional to gain in each 28-day period, and (3) proportional to number of animals. No real difference among the three methods was observed. Final adjustment was made using method 1.

The results of the 168-day test period are summarized in Table 1. The method of alfalfa pasturing appeared to have no effect on rate of gain. There was no appreciable difference in rate of gain of steers grazed in rotation (lots 14 and 15) and those pastured by the strip method (lots 16 and 17). In comparison with other treatments, it must be concluded that pasturing by either method was not conducive to high rates of gain. Steers fed alfalfa hay (lots 2 and 3) and supplemented green chopped alfalfa (lots 6 through 13) in dry-lot made significantly faster gains than steers on pasture. The feeding of unsupplemented green chop in dry-lot (lots 4 and 5) tended to produce faster gains than pasturing, although the difference was not statistically significant.

Statistical analysis revealed no significant differences between the gains obtained from the different rations fed in dry-lot. Conclusions based on these results must be restricted, therefore, regardless of apparent differences, until additional information from future work is available. It does appear, however, that supplementation of green chopped alfalfa with molasses or rolled barley tended to increase steer gains and that supplementation at the higher level with either supplement was no more effective in this regard than supplementation at the lower level.

Steers fed rolled barley at a level of two-thirds pound per 100 pounds live weight daily as a supplement to the freshly cut alfalfa (lots 8 and 9) did not gain faster than those fed one-half that amount (lots 6 and 7). When molasses was the supplement used, steers receiving the lower level (lots 10 and 11) tended to gain faster than those fed the higher level (lots 12 and 13). A comparison between the two types of supplements to alfalfa green chop shows that there was no appreciable difference in gains obtained, regardless of the supplement used, when both were fed at a level of one-third pound per 100 pounds live weight.

A relatively high rate of gain resulted from the feeding of alfalfa hay without any added supplement. The gains of steers fed alfalfa green chop with concentrate supplements did not exceed those obtained by feeding good quality hay as the sole source of nutrients. In addition, hay fed steers did not bloat.

Bloat was a major problem in the feeding and pasturing of green alfalfa. It is likely that, in addition to death losses, the bloat had an adverse effect on gains of steers that bloated but failed to succumb. The feeding of alfalfa straw with the green alfalfa may have been partially effective in reducing the incidence and severity of bloat; however, this practice was not wholly effective.

Average daily feed consumption is shown in Table 1. Since the roughages differed in moisture content at the time they were fed, a more accurate measure of nutrient consumption was obtained by determining feed consumption on a dry weight basis. Samples of the forages were taken at intervals and moisture content determined. Forage consumption, as presented in Table 1, is expressed on a dry weight basis.

TABLE 1. FEED CONSUMPTION AND BODY WEIGHT CHANGES OF EXPERIMENTAL STEERS - 1955-56

TREATMENT	1	2	3	4	5	6	7	8
LOT NO.	2 & 3	4 & 5	6 & 7	8 & 9	10 & 11	12 & 13	14 & 15	16 & 17
RATION FED	Hay	Green Chop + Straw	Green Chop + Straw + 1/3 lb. Barley per 100 lbs. live wt.	Green Chop + Straw + 2/3 lb. Barley per 100 lbs. live wt.	Green Chop + Straw + 1/3 lb. Mol. per 100 lbs. live wt.	Green Chop + Straw + 2/3 lb. Mol. per 100 lbs. live wt.	Pasture (Rotation) + Straw	Pasture (Strip) + Straw
No. steers	10	9	10	10	8	10	8	10
No. days fed	168	168	168	168	168	168	168	168
Ave. wt. change in feedlot lbs.								
Ave. initial wt.	621	622.2	622.5	621.5	606.2	614.0	628.8	627.5
Ave. final wt.	927	890.4	928.9	921.0	916.8	898.7	850.0	857.5
Ave. daily gain	1.82	1.60	1.82	1.78	1.85	1.69	1.32	1.37
Ave. daily feed consumed, lbs.								
Alfalfa hay	20.6	-----	-----	-----	-----	-----	-----	-----
Alfalfa green chop	-----	15.7	15.2	12.7	15.6	14.1	-----	-----
Alfalfa pasture	-----	-----	-----	-----	-----	-----	15.6	14.5
Alfalfa straw	-----	3.5	3.5	3.5	3.6	3.5	4.5	4.8
Barley, rolled	-----	-----	2.45	4.88	-----	-----	-----	-----
Molasses	-----	-----	-----	-----	2.46	4.88	-----	-----
Total	20.6	19.2	21.15	21.08	21.66	22.48	20.1	19.3
Feed per 100 lbs. gain, lbs.								
Alfalfa hay	1132	-----	-----	-----	-----	-----	-----	-----
Alfalfa green chop	-----	981	835	713	843	834	-----	-----
Alfalfa pasture	-----	-----	-----	-----	-----	-----	1182	1059
Alfalfa straw	-----	219	192	197	195	207	341	350
Barley, rolled	-----	-----	135	274	-----	-----	-----	-----
Molasses	-----	-----	-----	-----	133	289	-----	-----
Total	1132	1200	1162	1184	1171	1330	1523	1409

No marked differences in feed consumption were noted between steer groups on the various rations. Consumption was slightly higher when alfalfa was fed as hey (lots 2 and 3) than when fed green (lots 4 and 5).

For the pasture lots, feed consumption was estimated from clippings at the beginning of each period. This may underestimate feed availability, since plants added some growth during the grazing period. However, clipping methods are biased upward, since all forage is assumed to be available for consumption while animals may be selective in actual grazing. Data on feed availability for steers on pasture were not collected for the initial 28-day period and for the last 14 days of the third 28-day period, the latter due to scarcity of forage. This necessitated some estimation of consumption to obtain a comparable estimate to consumption in dry-lot. The missing data were estimated from total consumption during the 126 days for which data were collected. No method for assessing the accuracy of the estimate of feed availability can be made.

Assuming the estimate of pasture forage consumption to be accurate, steers grazed in rotation (lots 14 and 15) were less efficient in feed utilization than those grazed by the strip method (lots 16 and 17). Alfalfa was more efficiently utilized when fed as green chop (lots 4 and 5) than when pastured. A decrease in feed efficiency was noted when green chop was supplemented with the higher level of molasses. Steers fed molasses at a level of two-thirds pound per 100 pounds body weight (lots 12 and 13) required significantly more feed per unit of gain than those receiving the other supplements, green chop without a supplement, or hay alone. Although the difference was not statistically significant, alfalfa tended to be more efficiently utilized when fed as hay (lots 2 and 3) than when fed as green chop without a supplement (lots 4 and 5).

At the conclusion of the feeding trials, data were obtained on shrinkage, live grade, carcass grade and yield. These data are presented in Table 2. In determining shrinkage, cattle were held off feed and water for about 12 hours. Then they were weighed, immediately loaded on trucks, trucked from Yuma to the Cudahy Packing Company plant in Phoenix, and weighed off the truck.

Steers fed alfalfa hay (lots 2 and 3) and those fed green chop supplemented with the higher level of molasses (lots 12 and 13) tended to shrink more than other lots. The relatively low shrinkage of steers on strip pasture is not consistent with the shrinkage of other cattle fed green alfalfa without a supplement. With that exception, non-supplemented cattle tended to shrink more than those fed barley or the lower level of molasses.

Because of differences in shrink, average daily gains were calculated on the basis of off-truck weights, as shown in Table 2. Initial weight is weight into the feed-lot minus four percent shrink. Final weight is the actual off-truck weight of the cattle at the time they were unloaded at Phoenix.

Carcass grades were lower, on the average, than live grades. This difference is attributed in large part to a lower degree of internal finish and consequently less marbling than was indicated by apparent external covering.

There were no significant grade differences between lots fed alfalfa hay or supplemented green chopped alfalfa, although both live grades and carcass grades tended to be higher in the case of steers fed the higher level of barley (lots 8 and 9) and lower for those fed the higher level of molasses (lots 12 and 13). Steers fed a concentrate supplement with green chop tended to grade higher than those fed green chop without a supplement. As previously indicated, the higher level of barley tended to be most effective in this regard and the higher level of molasses least effective. The comparison between hay and green chop alone shows that cattle fed hay tended to grade higher and yield more desirable carcasses.

TABLE 2. SHRINKAGE AND SLAUGHTER DATA
FOR EXPERIMENTAL STEERS - 1955-56

TREATMENT	1	2	3	4	5	6	7	8
LOT NO.	2 & 3	4 & 5	6 & 7	8 & 9	10 & 11	12 & 13	14 & 15	16 & 17
RATION FED	Hay	Green Chop + Straw	Green Chop + Straw + 1/3 lb. Barley per 100 lbs. live wt.	Green Chop + Straw + 2/3 lb. Barley per 100 lbs. live wt.	Green Chop + Straw + 1/3 lb. Mol. per 100 lbs. live wt.	Green Chop + Straw + 2/3 lb. Mol. per 100 lbs. live wt.	Pasture (Rotation) + Straw	Pasture (Strip) + Straw
Shrink prior to loading								
Ave. lbs.	35.5	13.2	15.9	32.0	25.5	36.2	30.6	12.0
Percent	3.8	1.5	1.7	3.5	2.8	4.0	3.6	1.4
Shrink in transit								
Ave. lbs.	41.0	50.0	42.0	27.0	35.6	36.5	33.1	42.5
Percent	4.6	5.7	4.6	3.0	4.0	4.2	4.0	5.0
Total shrink								
Ave. lbs.	76.5	63.2	57.9	59.0	61.1	72.7	63.7	54.5
Percent	8.2	7.1	6.2	6.4	6.7	8.1	7.5	6.3
Ave. wt. change based on off-truck wt., lbs.								
Ave. initial wt. into feed-lot (minus 4 % shrink)	596.2	597.3	597.6	596.6	581.9	589.4	603.6	602.4
Ave. final wt. off truck At Phoenix	850.5	827.2	871.0	862.0	855.6	826.0	786.2	803.0
Ave. daily gain	1.51	1.37	1.63	1.58	1.63	1.41	1.09	1.19
Slaughter data								
Ave. live grade (1)	6.0	4.2	6.1	6.3	6.2	5.5	3.8	4.1
Ave. carcass grade (1)	5.3	3.9	5.2	5.6	5.2	4.3	3.1	2.4
Ave. yield, %	59.9	58.3	59.9	60.7	59.4	59.9	58.4	57.4
Ave. live value (2)	$18.35	$17.32	$18.22	$18.86	$17.97	$ 17.84	$17.03	$ 16.63

(1) Grade Factors: Top Choice, 10; Medium Choice 9; Low Choice, 8; Top Good, 7; Medium Good, 6; Low Good, 5; Top Standard, 4; Medium Standard, 3; Low Standard, 2; Utility, 1.

(2) Determined by grade and yield based on the following prices per cut: Choice, $33; Good, $31; Standard, $29; Utility, $27. Price for grade times yield equals live value per cwt.

TABLE 3. FINANCIAL SUMMARY FOR EXPERIMENTAL STEERS - 1955-56

TREATMENT	1	2	3	4	5	6	7	8
LOT NO.	2 & 3	4 & 5	6 & 7	8 & 9	10 & 11	12 & 13	14 & 15	16 & 17
RATION FED	Hay	Green Chop + Straw	Green Chop + Straw + 1/3 lb. Barley per 100 lbs. live wt.	Green Chop + Straw + 2/3 lb. Barley per 100 lbs. live wt.	Green Chop + Straw + 1/3 lb. Mol. per 100 lbs. live wt.	Green Chop + Straw + 2/3 lb. Mol. per 100 lbs. live wt.	Pasture (Rotation) + Straw	Pasture (Strip) + Straw
Financial Summary								
Ave. initial cost per steer (1)	$107.32	$107.51	$107.57	$107.39	$104.74	$106.09	$108.65	$108.43
Ave. feed cost (2)	45.90	40.30	49.63	54.82	48.20	51.57	30.22	29.67
Total	$153.22	$147.81	$157.20	$162.21	$152.94	$157.66	$138.87	$138.10
Ave. selling price per steer (3)	156.04	143.26	158.72	162.62	153.77	147.35	133.89	133.51
Difference	2.82	-4.55	1.52	.41	.83	-10.31	-4.98	-4.59

(1) Based on price of $18.00 cwt.
(2) Feed prices used: alfalfa hay, $25 T; alfalfa green chop, $7 T (green wt. as chopped); alfalfa straw, $15 T; rolled barley, $50 T; cane molasses, $35 T; alfalfa pasture, $5.25 T (green wt. consumed).
(3) Wt. off truck times live value per cwt. equals selling price.

Steers fed hay or supplemented green chop tended to dress out higher than those maintained on pasture, or those fed green chop without a supplement. Of the supplemented steers, those fed the higher level of barley tended to dress out higher. Despite the tendency of animals fed the higher level of molasses to gain less and grade lower than those fed hay alone or green chop supplemented with other supplements tested, the dressing percentage of the steers on high molasses was not inferior. Relative yields may have been influenced somewhat by differences in shirinkage prior to loading and during shipment to market.

The cattle were sold on a grade and yield basis. Average values per 100 pounds live weight based on grade and yield were lowest for cattle on pasture and those fed green chopped alfalfa without a supplement. The differences in selling prices between the lots of steers emphasize the importance of grade and yield, in addition to rate and efficiency of gain, in determining the effectiveness and relative value of difference rations.

A financial summary, showing the average return or loss per steer for the different treatments, is presented in Table 3. With feed prices used and cattle prices received, four of the steers groups showed a return in excess of combined feed and purchase costs. Steers fed hay showed the greatest return. Low level supplementation of green chop was more profitable than high level supplementation and, at each level tested, steers fed barley returned more than those supplemented with molasses. Supplementation of green chop with the higher level of molasses resulted in a loss of considerable magnitude, representative of the combined results of relatively low feed efficiency, comparatively high shrinkage, and lower carcass grades in comparison with other supplemented cattle. Losses also resulted when alfalfa was pastured or fed as green chop without a supplement.

The interpretation of results in terms of relative economy and financial return is subject to change as changes occur in such factors as cattle and feed prices. The financial summary also reflects certain differences which may not be true differences. The extent to which this is true can be determined only by added experimentation involving the same treatment comparisons. Relative labor costs of harvesting and feeding alfalfa as hay, green chop, or pasture, are not included in this report. The results of this phase of the work will be made available when completed.